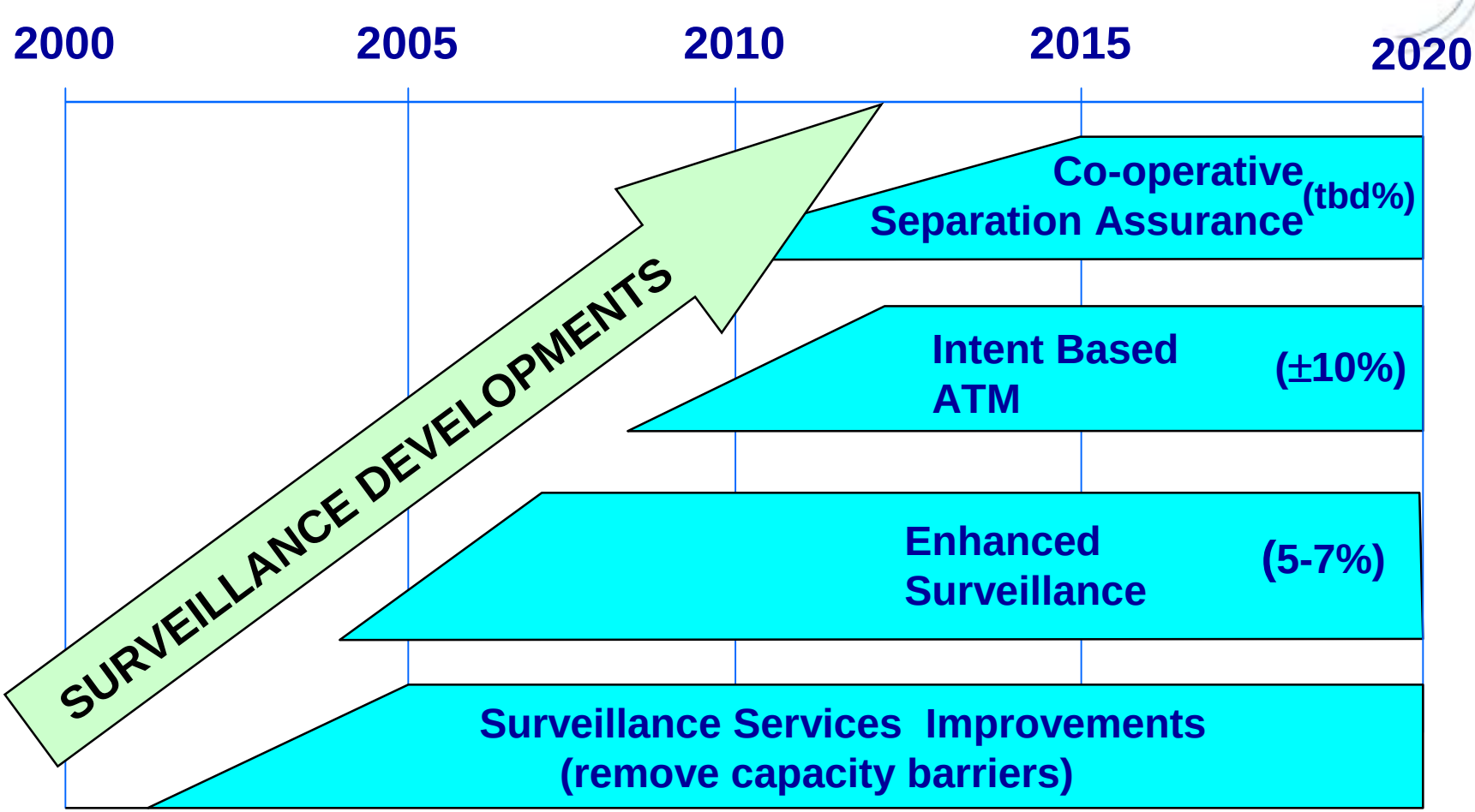
Update from the Mode S Programme

- ***Mode S Programme Overview***
  - Objective and Scope
  - Geographical Extent
- ***Mode S Programme Status***
  - Elementary Surveillance
  - Enhanced Surveillance
- ***Mode S Implementation***
  - Elementary Surveillance 2003
  - Enhanced Surveillance 2005

ATM 2000 + Strategy



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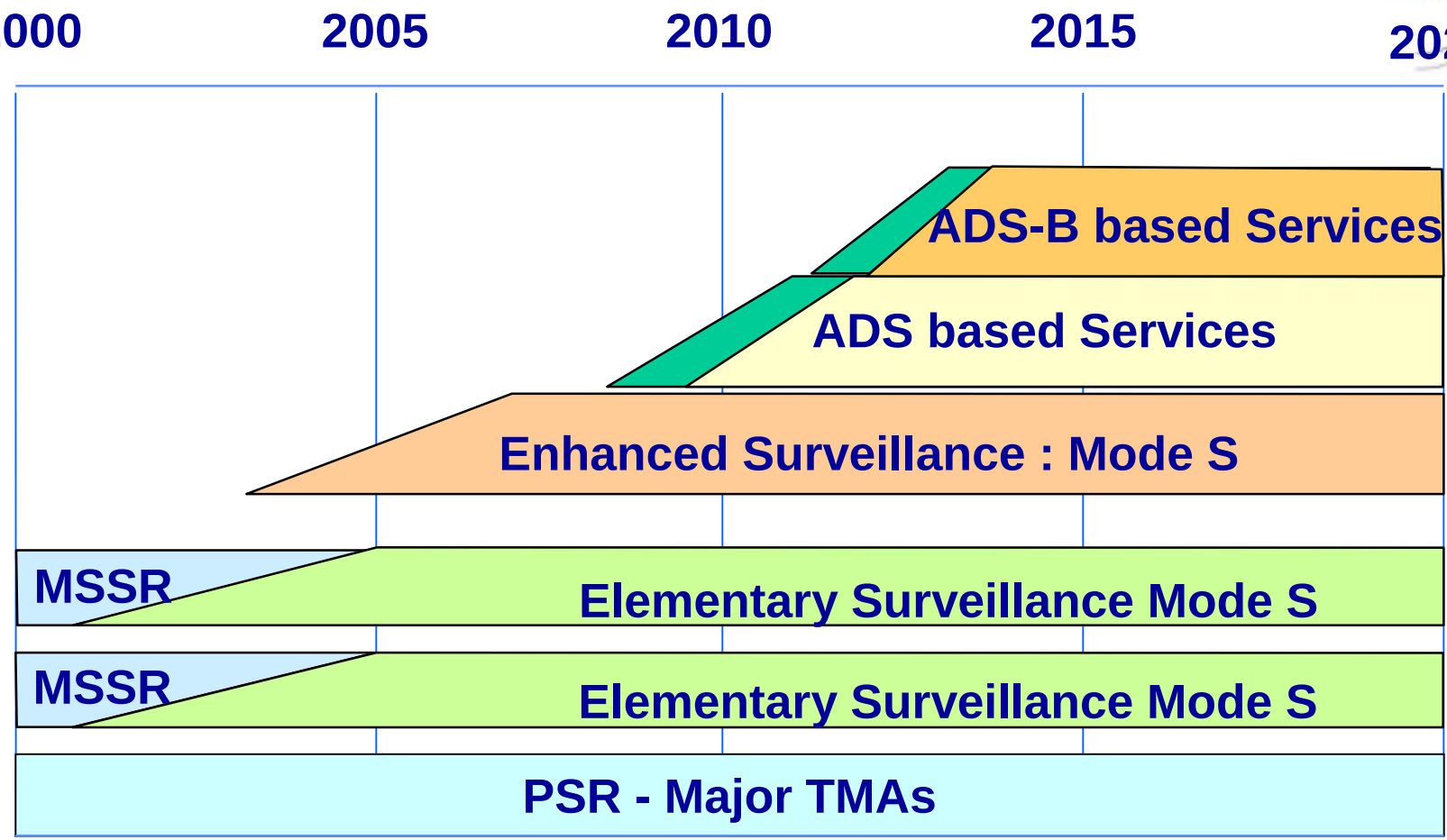
Services in the Core Area of Europe



Mode S Programme

Overview

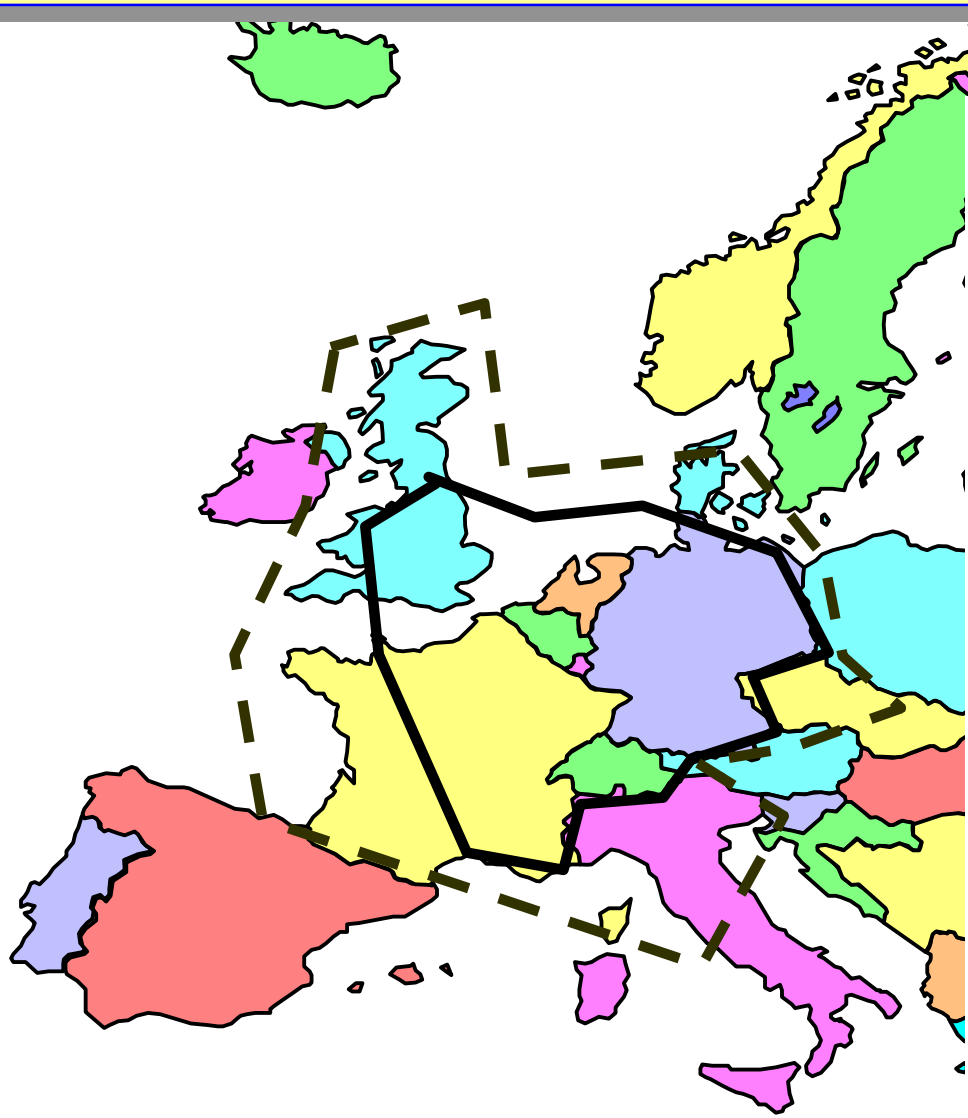
An Implementation Programme

- The States and Airspace Users implement
- EUROCONTROL coordinates
- EUROCONTROL conducts common work

Benefit driven .. not Technology driven

- Problem-solving approach
- CBA-based & Safety orientated

Mode S Programme - Overview



Initial Mode S Area

Civil Coverage

78 % of ECAC flights take partly place in the Core area of Europe

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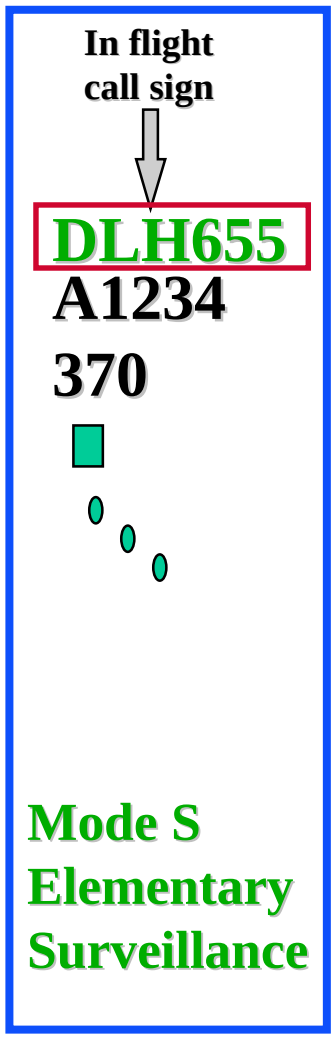
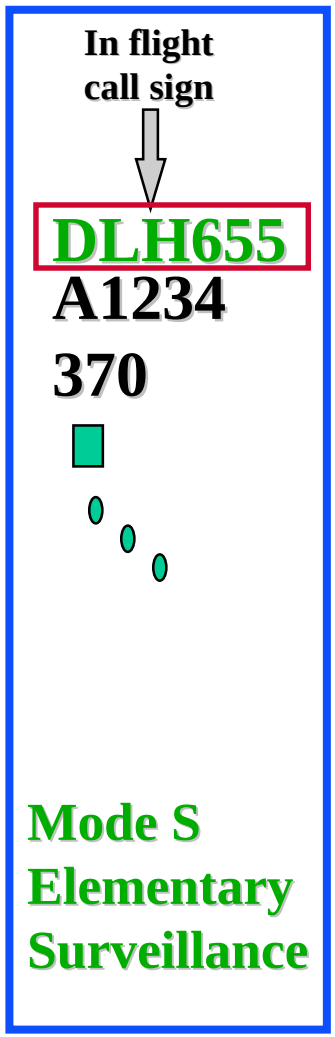
Mode S Elementary Surveillance



- Elementary Surveillance aims at solving the current Surveillance infrastructure limitations:
  - RF interference which already leads to saturation, detection issues and therefore capacity limitations
  - Mode A Code shortage which is already experienced since 99 in Germany and France and which limits traffic growth

Mode S Elementary Surveillance



❖ Elementary Surveillance requires:

☞ A Transponder fully compliant with ICAO SARPs Amendt 73 …

☞ .. Supporting the SI code capability

☞ Downlink of Aircraft identity (flight plan call-sign; otherwise aircraft registration);

note: a Transponder retrofit is needed

Mode S Elementary Surveillance

Benefits

❖ **The implementation of Mode S Elementary Surveillance is a prerequisite for:**

☞ **maintaining the current level of safety while allowing for further growth in traffic in the Core Area of Europe.**

Costs are huge : 1 b Euro

split as follows

Air side: 800 m Euro

Ground: 200 m Euro

(including Mode S Transponders)

Benefits / Costs
> 10 : 1

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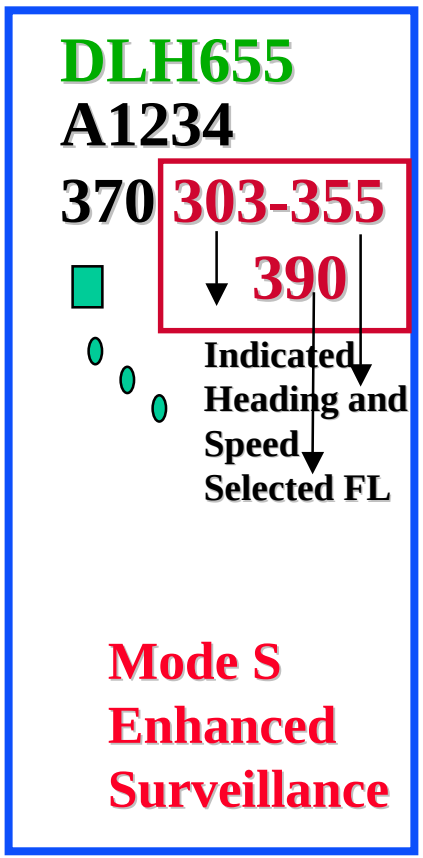
Mode S Enhanced Surveillance

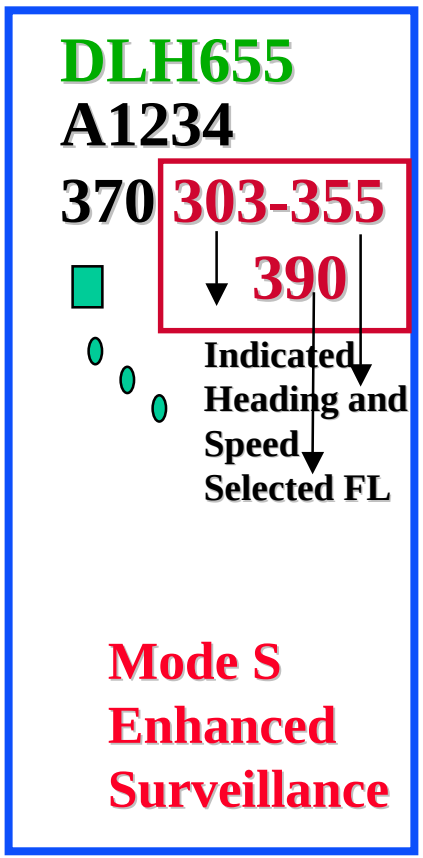


❖ Enhanced Surveillance aims at Safely increasing the ATM Controllers' efficiency:

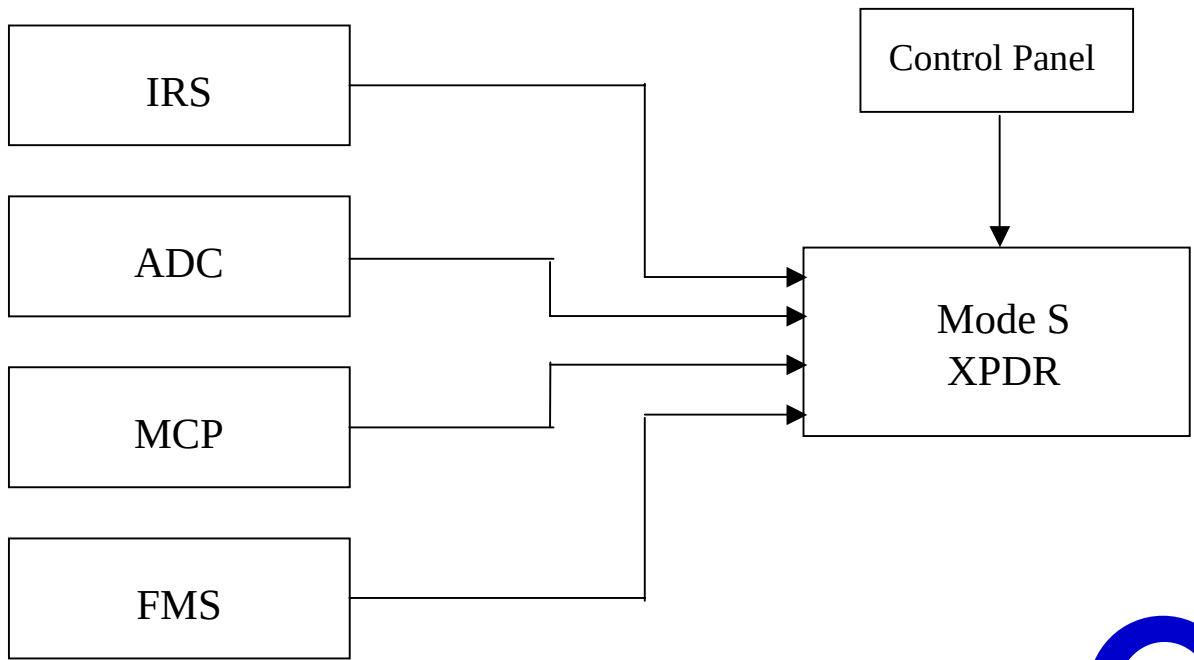
☞ Display of Controller Accessed Parameters: reducing R/T workload and raising situational awareness

☞ System Enhancements such as Level Burst Alerting Tool, Tracking, MSAW, STCA improvements leading to Safety improvements

Mode S Enhanced Surveillance



- Enhanced Surveillance requires:
  - ☞ New Wiring in Aircraft to enable the Parameters to be downlinked



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Mode S Enhanced Surveillance

Benefits

❖ **The implementation of Mode S Enhanced Surveillance is a strategic improvement of the EUROCONTROL ATM 2000+ Strategy :**

- ☞ **it enables 5 to 7 % increase in capacity while improving Safety**
- ☞ **this converts into 30 % reduction of en route and approach ATFM Delays**

Costs are moderate :

split as follows

Air side: < 265 m Euro (if Enhanced independent of Elementary)

Ground: ~ 50 m Euro

CBA

IRR 22 %

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Mode S Programme Overview

Scope & Dates

- ***Mode S Radars are deployed from 2002 onwards***
  - ☞ to overcome the current radars limitations in high density airspace (capacity barrier n°1)
- ***Elementary Surveillance is implemented in 2003***
  - ☞ Aircraft ID implemented in FDPS (call sign-reg. n°) to overcome code A shortages (capacity barrier n°2)
- ***Enhanced Surveillance is implemented in 2005-7 (TBC)***
  - ☞ HMI improvements to increase capacity and enhance safety (ATM 2000+ Strategy)
- ***No ATN Data-Link in the Programme***

Implementation Decisions

Outcome of Provisional Council 7 - April 2000

- ***Elementary Surveillance implementation is approved***
  - States are mandating Elementary Surveillance ..
  - .. in line with EUROCONTROL Specimen AIC
  - Date of implementation is **March 2003**

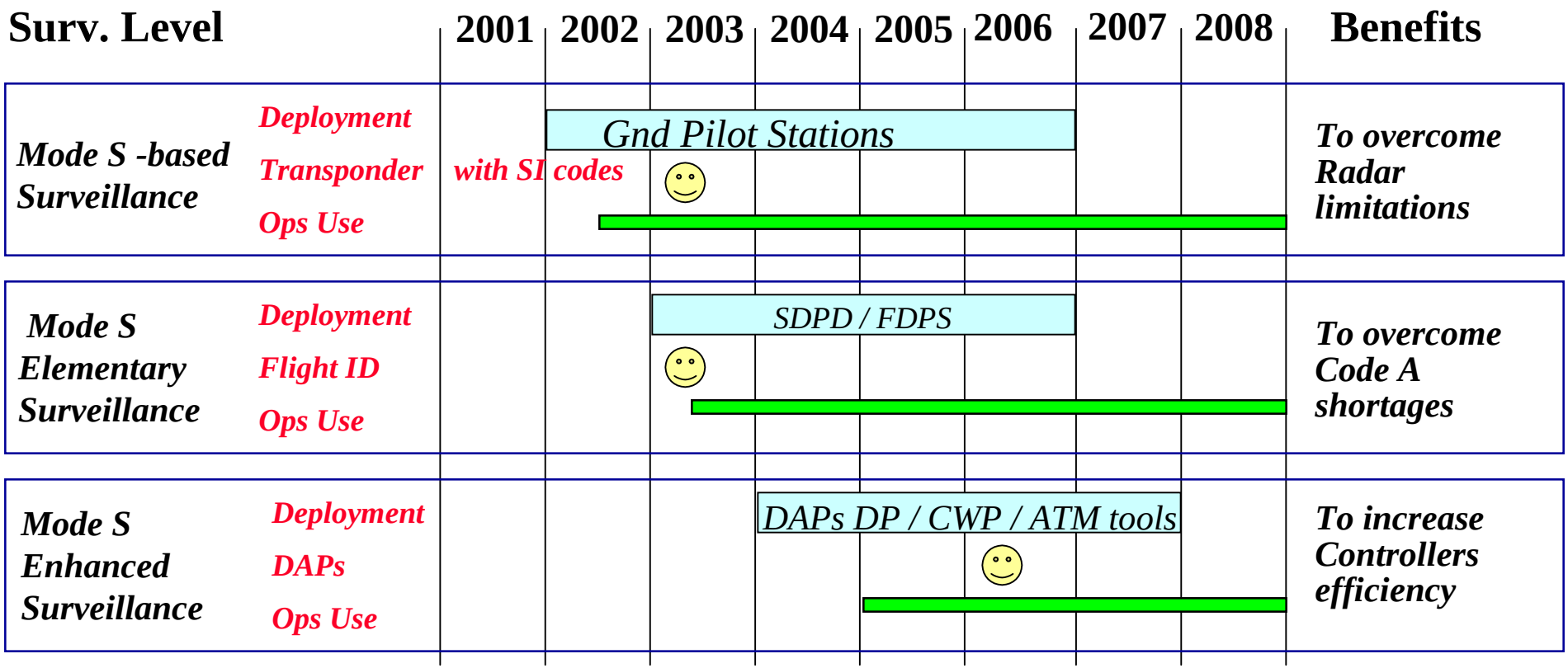
Enhanced Surveillance case conditionally accepted

- ***Enhanced Surveillance Business Case calls for a decision***
  - Enhanced Surveillance target date is **March 2006**
  - Implementation rule is being defined
  - Commitments from ANSPs are being reviewed

- **Core Area States are committed to the Programme**

Mode S Programme Overview

Time-scales



Legend ☺ *Mandates for IFR Aircraft (with exemption policy)*

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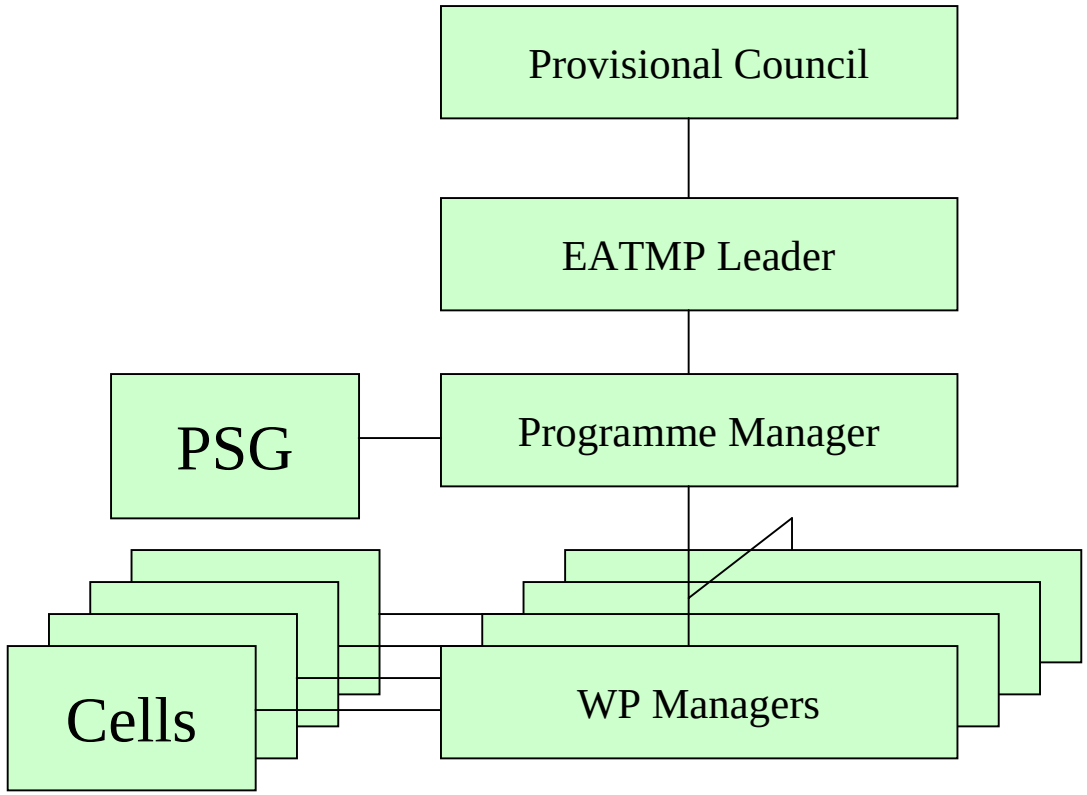
Mode S Programme Overview

WBS & Deliverables

☞ **WP1: Management**	**Set-up of a "*Code Allocation Body*"**
☞ **WP2: Operational Requirements**	**Operational Guidelines & Procedures**
☞ **WP3: Mode S System**	**System Design Document**
☞ **WP4: Ground Stations & tools**	**Common Specs and validated Design of Ground Station & Tools**
☞ **WP5: SDPD & tools**	**ARTAS / SASS-C Mode S versions**
☞ **WP6: ATM User functions**	**Guidelines for FDPS /CWP modifications**
☞ **WP7: Airborne aspects**	**Monitoring of the Implementation Support to Implementation**

Mode S Programme Overview

Organisation



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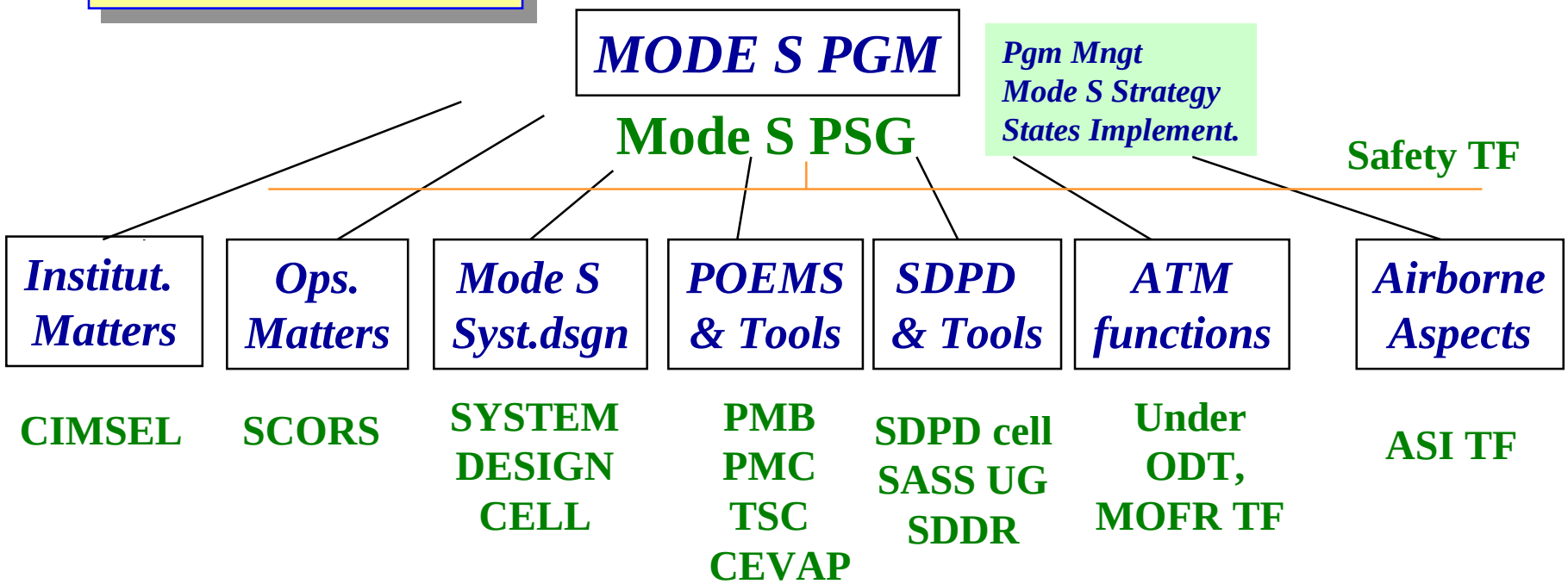
Mode S Programme Overview

Working Arrangements



Mode S Programme Status

Ground Sensors Civil Implementation

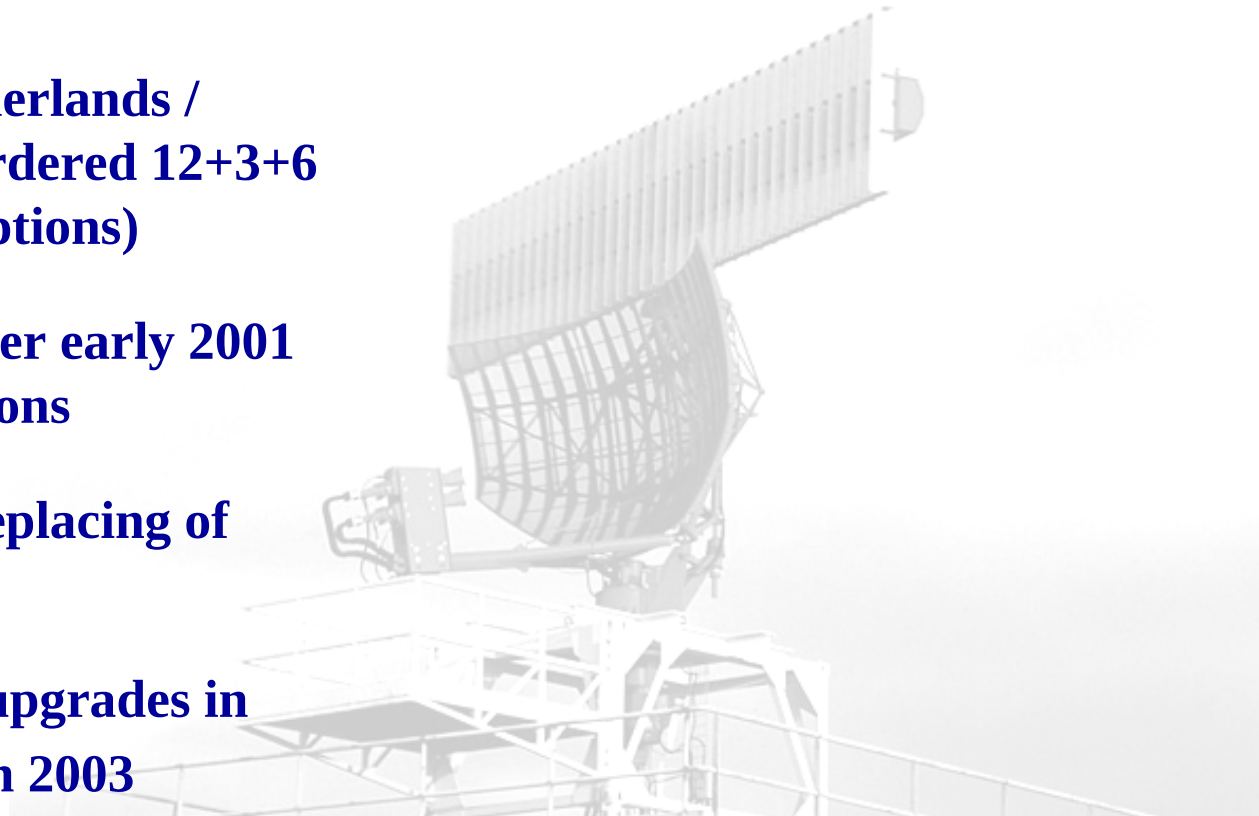
- POEMS Mode S ground stations (phase 1) have passed factory and site acceptance testing (June 00/ July 00 and November 00/ December 00)

- ARTAS Elementary Surveillance Tracker and Server is developed (FAT of V6b passed in December 00) Operational implementation in 2001

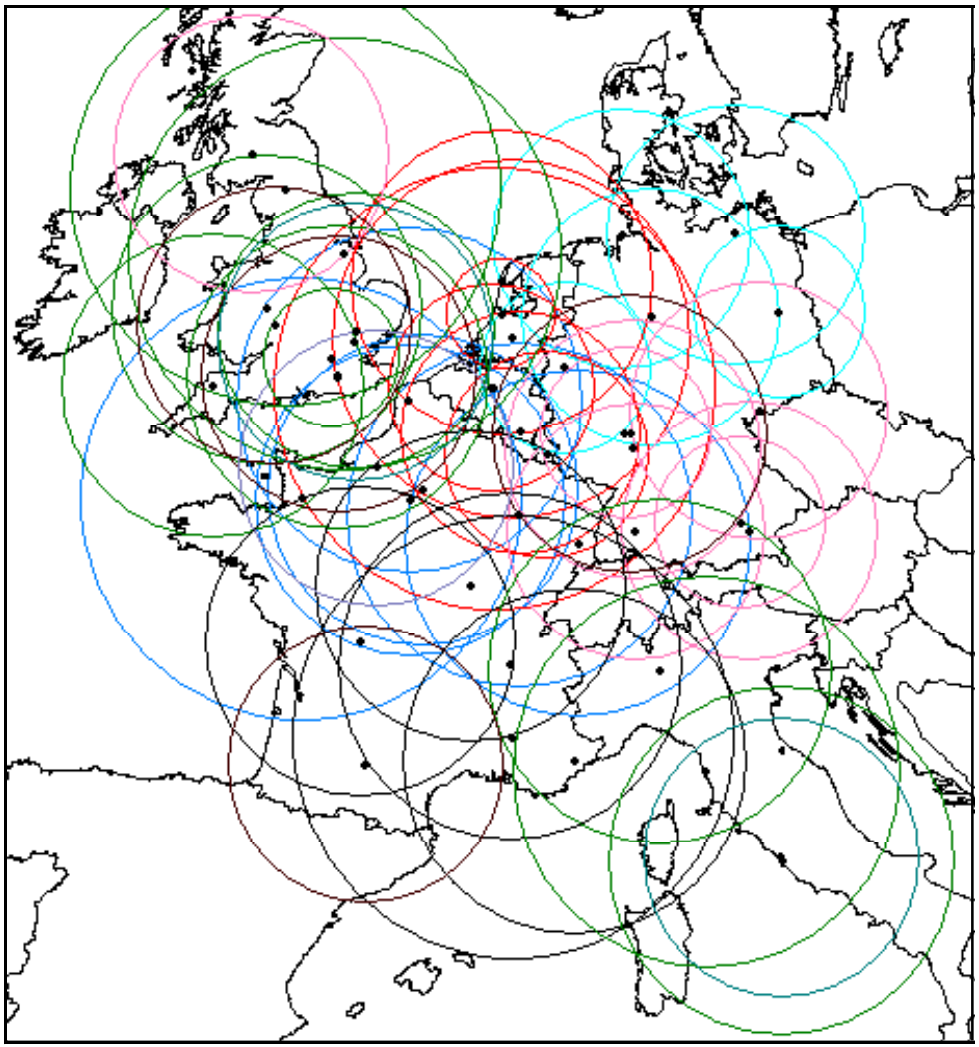
Mode S Programme Status

Ground Sensors Civil Implementation

- Germany / The Netherlands / Switzerland: have ordered 12+3+6 Mode S stations (+ options)
- France: call for tender early 2001 for 6/10 Mode S stations
- UK: are currently replacing of 14/19 Radar Stations
- Belgium: 2 Mode S upgrades in 2001; a new station in 2003



Mode S Programme Status



50 civil radars are expected in the Core Area by 2005

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Elementary Surveillance Regulations

- **Specimen AIC issued by EUROCONTROL in July 2000 the best common result the States could reach**
- **Regulators are now regulating ...**
  - Section 2.3. of the AIC : Dates
    - IFR 2003 (31 March)
    - VFR 2005 (31 March in designated airspace)
  - Section 5 : Coordinated Exemptions
    - 5.1.1. States “will make every effort” to honour them
    - 5.2.2. Eligibility :
      - VFR already mode A/C equipped (until March 2008)
      - Special flights, some State aircraft, ..

Elementary Surveillance Specimen AIC

AIC Highlights

- Mode S & Transponder Specific Requirements
  - SI (Surveillance Identifier) codes are needed
  - Aircraft ID is needed for Mode A Code shortage alleviation

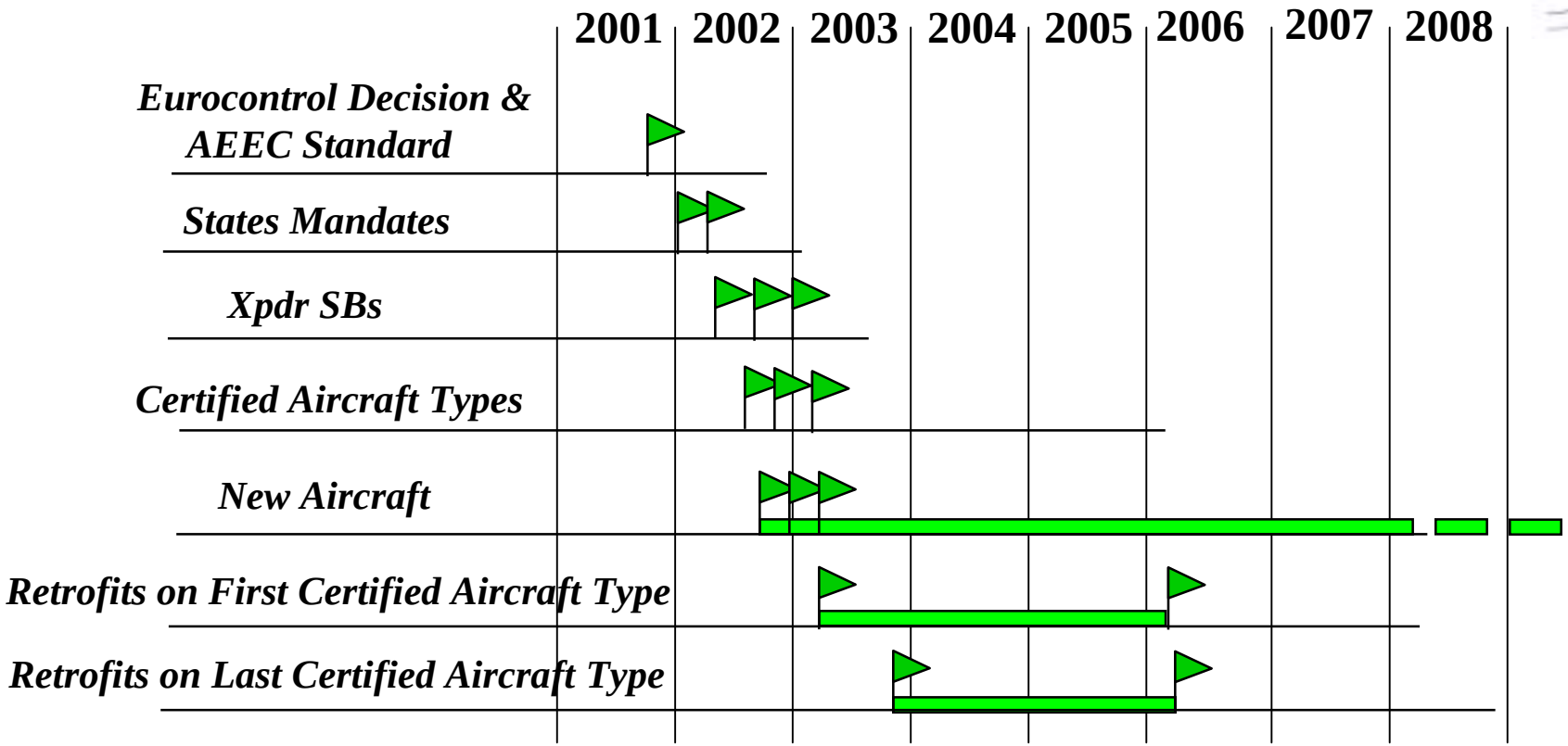
- NB : It is recommended that the transponders include all the following features :
  - SI codes
  - ACAS 2 upgrades
  - DAP capability (Enhanced Surveillance)
  - Long Squitter future capability

Mode S Programme Status

Enhanced Surveillance Status

- DAP workshop - April 99 - identified the need to refine the CBA
- Enhanced Surveillance is heavily linked to Business Case (Capacity) ; Major Safety Benefits are identified but not quantified
- FTS results for Karlsruhe airspace (Germ) have clearly demonstrated a 5% to 7% Capacity increase in relation to Controllers' use of Enhanced Surveillance
- The Business Case has been refined by end 2000 and is being reviewed by Stakeholders
- Airlines have expressed a conditional acceptance of the Case
- Further discussions are on going with Stakeholders in order a mutually acceptable deal can be prepared

Enhanced Surveillance Airborne Implementation



- ☞ New aircraft would be equipped by 2003
- ☞ By 2005, 50 % of the Digital Aircraft would be equipped
- ☞ By 2007, 100 % of the Digital Aircraft would be equipped

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Enhanced Surveillance

Mode S CBA

- ***Cost Benefit Analysis Results*** (Base case)
  - Two step implementation: Elem by 2003/Enh by 2007
  - Digital and partly digital commercial aircraft only
  - Fourteeen ATC Centres with useable correlations
  - Costs and benefits for period up to 2017
  - Three CAPs only for benefits assessment
  - New avionics costs
  - ECIP capacity increases to 2005, then 3% p.a.
    (keeps average delay within 3.5 (2001 target) and 4.5 minutes (2000) per flight)

  - IRR = 22 %; first positive return by 2011; very resilient case

Case for Enhanced Surveillance

Conclusions

- *Proposed Approach :*
  - *SUR Road Map :* ***European ATM needs Enhanced Surveillance***
  - *Technology Comparison :* ***Mode S is the only possible choice***
  - *CBA :* ***Reasonably Good Return on Investment***
  - *Safety Benefits :* ***Level Bust Issue will be addressed***
  - *Recommendation :* ***Approval of the Implementation by 2006***
    - *Implementation Scenario :*
      - *Digital (and Partly Digital) most common aircraft types only*
      - *Mandate for New Aircraft* *March 2003*
      - *Mandate for All Aircraft* *March 2006*

Enhanced Surveillance Case

Decision Process

- Decision Making approach / milestones :
  - *Elements of the refined Business Case : December 2000*
  - *Meetings with the main actors : December 2000*
  - *Drafting of Refined Business Case : December 2000*
  - *Distribution to ACG of the Business Case : January 2000*
  - *Eurocontrol ACG Meeting : March 2001*
    (indication on decision to proceed : conditional acceptance by Airlines)
  - *Discussions on Implementation : April to December 2001 ?*
  - *PC Meeting : between July 2001 and April 2002 ??*
  - *States Regulations : between end 2001 and mid 2002 ??*

Mode S Programme

THANK YOU

Mode S Programme

Glossary

AIC	Aeronautical Information Circular
ARTAS	ATC suRveillance Tracker And Server
ASTERIX	All-Purpose Structured Eurocontrol Radar Information Exchange
CAP	Controller Access Parameters
CBA	Cost Benefit Analysis
CWP	Controller Working Position
DAPs	Downlink Aircraft Parameters
FTS	Fast time simulation
MSAW	Minimum Safe Altitude Warning
OLDI	On-Line Data Interchange
POEMS	Pre-Operational European Mode S
PTE	POEMS Test Equipment
SASS	Surveillance Analysis Support System
STCA	Short Term Conflict Alert